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EXAMINER

UMEZ ERONINI, LYNETTE T

ART UNIT PAPER NUMBER

1765

DATE MAILED: 06/16/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/943,196

Applicant(s)

MAY, CHARLES E.

Examiner

Lynette T. Umez-Eronini

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 30 March 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1,3,5-17 and 21 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,3,5-8,12,14 and 21 is/are rejected.
- 7) ☒ Claim(s) 9-11,13 and 15-17 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### *Claim Rejections – 35 USC § 102*

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

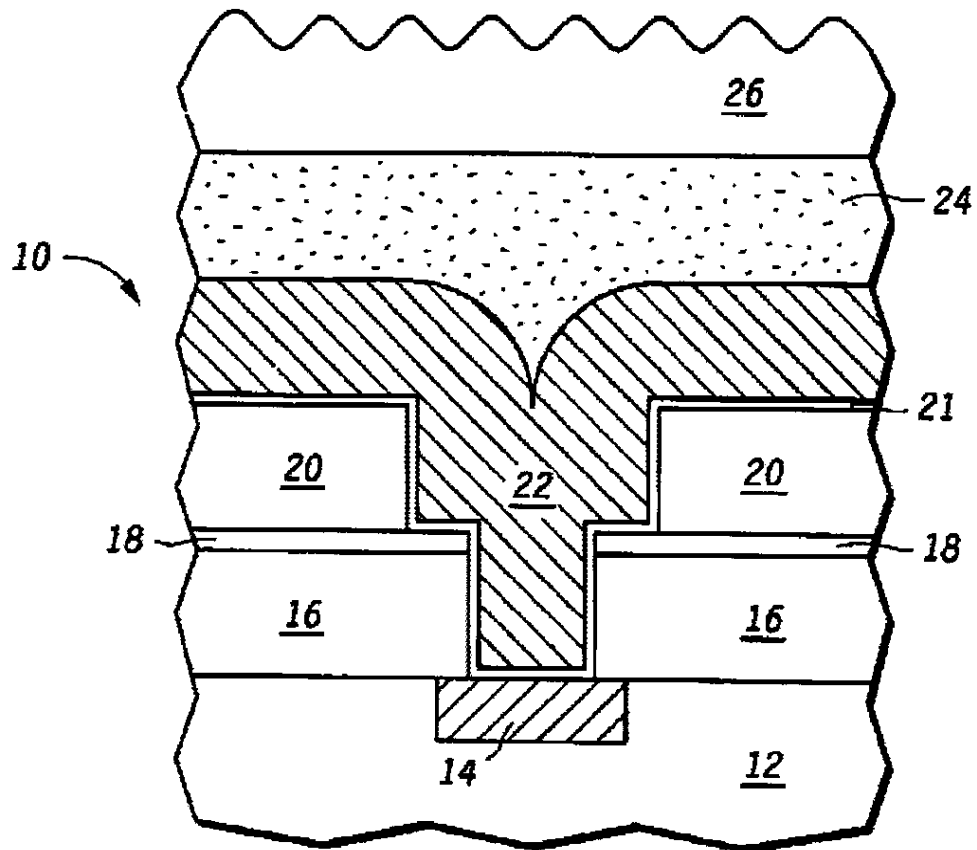
2. Claims 1, 3 and 12 are rejected under 35 U.S.C. 102(a) as being anticipated by Farkas et al. (US 6,001,730).

Farkas teaches, "The present invention relates generally to semiconductor manufacturing, . . ." (column 1, lines 7-10). "**FIG. 1** illustrates a semiconductor structure **10** which has a substrate **12**" (column 3, lines 51-52). **FIG. 3** illustrates that the structure **10** of **FIG. 1** is placed into a chemical mechanical processing (CMP) tool" (column 5, lines 24-25). "The copper layer **22** of **FIG. 1** is placed into contact with a chemical mechanical polishing (CMP) slurry **24** as illustrated in **FIG. 3**. The . . . polishing pad **26** in the CMP tool is placed in contact with the slurry **24** and is mechanically rotated and applied with pressure in order to result in effective chemical/mechanical removal of upper portions of the layer **22** In **FIG. 3**" (column 5, lines 35-42).

Farkas also teaches, "The slurry **24**, illustrated in **FIG. 3**, contains . . . an abrasive slurry/agent, a solvent, . . ." (column 5, lines 61-64). "Typical solvents used in the slurry **24** of **FIG. 2** is one or more of deionized water (H<sub>2</sub>O) or an

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alcohol" (same as a nonaqueous solvent) . . . A remaining balance of the slurry 24 is typically deionized water and/or an alcohol solution" (column 6, lines 10-24).



**FIG. 3**

The aforementioned further reads on,

The above reads on,

A method of fabricating a semiconductor wafer, comprising:

(a) polishing the semiconductor wafer with a polishing pad; and

(b) disposing a volume of a non-aqueous solvent onto said semiconductor

wafer, in claim 1;

said polishing pad is in contact with said semiconductor wafer when said nonaqueous solvent is disposed onto said semiconductor wafer, **in claim 3**; and

A method of fabricating a semiconductor wafer, comprising:

(a) subjecting a front side of said semiconductor wafer to chemical mechanical polishing using an aqueous slurry; and

(b) disposing a volume of a nonaqueous solvent onto said front side of said semiconductor wafer during said chemical mechanical polishing, **in claim 12**.

### ***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of

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35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Farkas (US '730) as applied to claim 1 above, and further in view of Merchant et al. (US 6,436,830 B1).

Farkas differs in failing to teach said nonaqueous solvent includes an ammine.

Merchant teaches, "The CMP slurry **10** includes a first emulsion **11** having a continuous aqueous phase (AQ<sub>E</sub>) **12** and a second emulsion **13**. . . . The first emulsion **11** includes abrasive particles **18** . . . The second emulsion **13** preferably comprises an organic phase (ORG) **14** and a dispersed aqueous phase (AQ<sub>I</sub>) **16** for capturing metal particles polished from the semiconductor wafer **20**" (column 3, lines 49-60). "The organic phase **14** may comprise alcohol or iso-alcohol and preferably includes at least one complexing agent such as, from example, . . . bi-pyridine (which is an example of a nonaqueous ammine) . . ." (column 4, lines 12-19).

It would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Farkas' polishing composition by including a nonaqueous solvent such as an ammine that is taught by Merchant for the purpose of capturing metal particles polished from the semiconductor wafer (Merchant, column 3, lines 56-60).

6. Claims 8 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Farkas (US '730) as applied to claims 1 and 12 respectively above, and further in view of Zhou et al. (US 5,780,358).

Farkas differs in failing to teach said nonaqueous solvent includes dimethylsulfoxide (DMSO).

Zhou teaches "Preferably, the non-aqueous coordinating solvent with the Chemical-Mechanical Polishing (CMP) slurry composition of the present invention is chosen from the group of . . . (DMSO)" (column 8, lines 1-6). "In addition to the non-aqueous coordinating solvent, . . . the abrasive powder, various other components may optionally be included within the Chemical-Mechanical Polishing (CMP) slurry composition of the present invention. These components include but are not limited to . . . aqueous and non-aqueous co-solvents . . . and the like as are know in the art to impart other desirable properties to the Chemical-Mechanical Polish (CMP) slurry composition of the present invention" (column 8, lines 40-49).

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Farkas' polishing slurry by including DMSO to a polishing slurry, as taught by Zhou for the purpose of assisting in rapid dissolution of copper metal under mild conditions (column 7, lines 51-55).

7. Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Farkas (US '730) in view of Kobayashi (US '045)

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Farkas differs in failing to teach (c) mixing said aqueous slurry containing an abrasive material and a nonaqueous solvent in a mixing unit so as to create an aqueous slurry/nonaqueous solvent mixture prior to being disposed onto said semiconductor wafer.

Kobayashi teaches, "A chemical-mechanical polisher **(10)** includes a mixer section **(12)** that mixes components of a polishing fluid prior to introducing the polishing fluid onto a polishing section **(13)** of the polisher **(10)**" (Abstract). "For example, container **111** may include concentrated polishing fluid, and container **112** includes a diluent, such as water, an alcohol, a glycol, and the like" (column 3, lines 17-19). "A polishing fluid may include only liquids or include at least one liquid and particles" (column 5, lines 63-64), which provides evidence that Kobayashi's polishing fluid is the same as applicants aqueous slurry and further reads on, mixing an aqueous slurry containing an abrasive material and a nonaqueous solvent in a mixing unit. Since Kobayashi mixes an aqueous slurry and nonaqueous solvent as claimed in the present invention, then using Kobayashi's method of mixing an aqueous slurry and nonaqueous solvent in the same manner as that of the claimed invention would create an aqueous slurry/nonaqueous solvent mixture prior to being disposed onto said semiconductor wafer.

It would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Farkas' slurry by using Kobayashi's method of mixing an aqueous slurry and nonaqueous solvent for the purpose of



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having a higher polishing rate than is achieved with a batch mixing system (Kobayashi, column 6, lines 16-18).

8. Claims 5 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Farkas (US '730) in view of Kobayashi (US '345) as applied to claim 21 above.

Farkas in view of Kobayashi differs in failing to teach (c) increasing the weight % of said nonaqueous solvent in said aqueous slurry/aqueous solvent mixture during said polishing of said semiconductor wafer, **in claim 5**; and said weight % of said nonaqueous solvent in said aqueous slurry/aqueous is increased until said aqueous slurry/nonaqueous solvent mixture is substantially free of said aqueous slurry, **in claim 6**.

It is known that abrasive slurries can scratch a semiconductor surface and increasing the said solvent concentration would result in the solvent becoming a bulk solution that would thereby dilute the components of the slurry until their concentration become negligible. Hence, it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to use a known method of increasing the concentration of a solvent for the purpose of reducing the degree of scratching due to the presence of abrasive materials.

***Allowable Subject Matter***

9. Claims 9, 10, 11, 13, 15-17 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

10. The following is a statement of reasons for the indication of allowable subject matter: As to claims 9, 10, 11, 13, and 15-17, the prior art of record, taken either alone or in combination fails to teach or suggest obvious a method of polishing a semiconductor wafer with an aqueous slurry along with a nonaqueous solvent that includes either an ammine, N,N-propanalamide, aniline, and N,N-dimethylaniline.

***Response to Arguments***

11. Applicant's arguments with respect to claims 1-20 (see Remarks on pages 6-13 of amendment filed 12/29/2003, which are incorporated in the amendment filed 3/30/2004), have been considered but are moot in view of the new ground(s) of rejection. Applicant's newly amended claim 21, which contains limitations that are directed to mixing an aqueous slurry containing an abrasive material and a nonaqueous solvent in a mixing unit so as to create an aqueous slurry/nonaqueous solvent mixture prior to being disposed onto said semiconductor wafer, raise new issue that required further search and consideration.

***Conclusion***

12. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lynette T. Umez-Eronini whose telephone number is 571-272-1470. The examiner can normally be reached on is normally unavailable on the First Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Itue

June 4, 2004

**NADINE G. NORTON**  
**SUPERVISORY PATENT EXAMINER**

A handwritten signature in black ink, appearing to read "Nadine Norton", is positioned below the printed name and title.